

Deuterammina (Lepidodeuterammina) subgen. nov., and a redescription of *Rotalina ochracea* Williamson (Protozoa: Foraminiferida)

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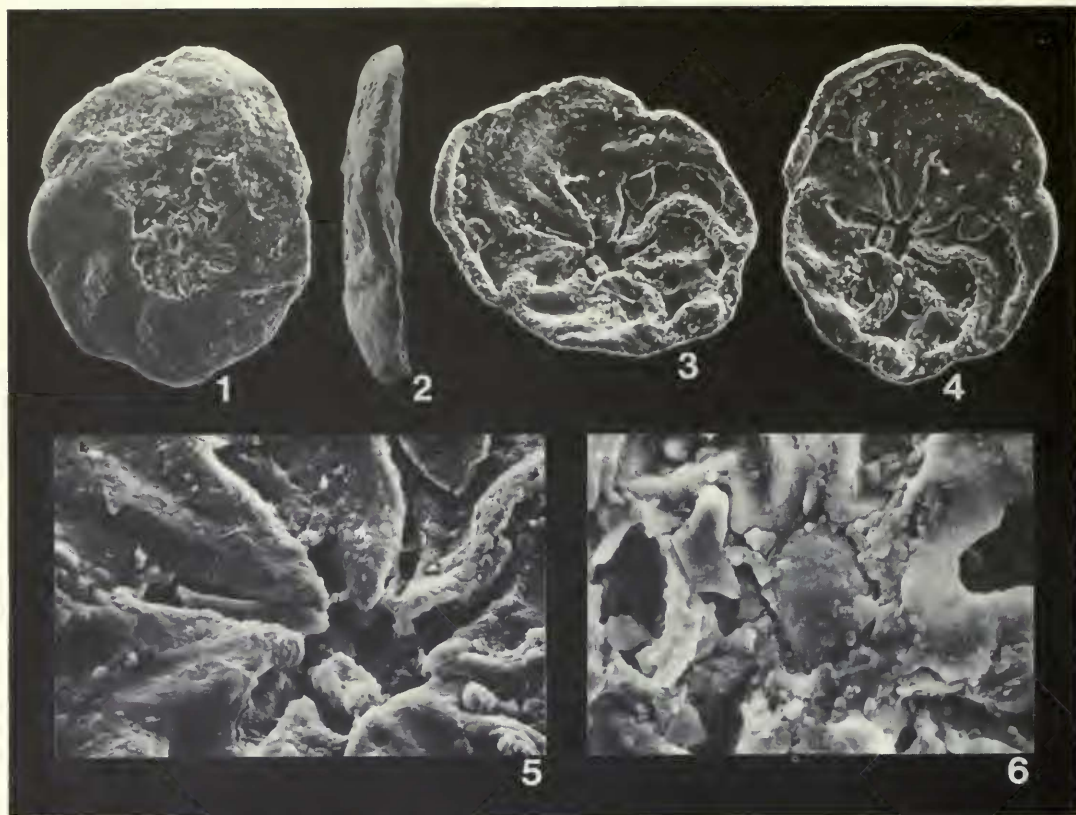
I. A lectotype for *Rotalina ochracea* Williamson

Rotalina ochracea Williamson (1858) was based on three specimens obtained from 'sand from Shetland'. Spiral and umbilical views, probably of the same specimen, were illustrated (figs 112, 113) and the species was described in the classic monograph *On the Recent Foraminifera of Great Britain* as follows (p. 55). . .

Shell trochoid, depressed; slightly convex and smooth superiorly, correspondingly concave inferiorly; with about two and a half convolutions; arcuate; filled with brown animal matter, which is pale and translucent in the ultimate segments, but very dark and opaque in those near the umbilicus. Septa smooth in one specimen, a little elevated in another; broad, and of light ochraceous yellow, contrasting richly in the dark tint of the segments. The connecting spiral has the same ochraceous line. Inferiorly the segments of the last convolution extend nearly to the umbilicus, concealing the rest. Segments depressed or concave. Septal lines arcuate, flexuose and very prominent.

Balkwill & Millett (1884) recognised the agglutinated nature of the test and transferred it to *Trochammina*. For a history of *Trochammina*, see Hedley *et al.*, 1964: 418. Although *Trochammina ochracea* (Williamson) is one of the most frequently reported species of the genus (see for instance, Heron-Allen & Earland, 1915; Cushman, 1920; Rhumbler, 1938; Höglund, 1947; Todd & Low, 1961; Murray, 1971; Haynes, 1973; Lutze, 1974) its detailed morphology is for the most part poorly known. Williamson's figured specimen is, unfortunately, not in the remaining part of his collection in the British Museum (Natural History) and must be considered lost. The other two specimens (syntypes) are, however, extant and were figured by Hedley *et al.* (1964; figs 2, 3). In spite of this work, the species continues to be largely misidentified and it is now thought necessary to designate a lectotype and describe and illustrate the species afresh, using the benefits of scanning electron microscopy (SEM). Particular attention is paid to details of the apertures, in the light of recent advances in trochamminid taxonomy (see p. 236, below). The lectotype chosen bears the BMNH reg. no. 1963.2.19.16 and is illustrated in Figs 1–8, 10, herein.

DESCRIPTION. (Lectotype). Test a concavo-convex, strongly compressed ('watch-glass' shaped) dextral trochospire comprising some 26 chambers arranged in almost 3 whorls, with 8 chambers in the final whorl. In outline the test is oval and slightly lobate; the periphery is rounded-compressed. Proloculus ellipsoidal $15 \times 10 \mu\text{m}$ in diameter. The chambers increase rapidly in size, those of the last whorl almost doubling in tangential diameter. Sutures curved and weakly depressed in the last whorl. Sutures on umbilical side strongly



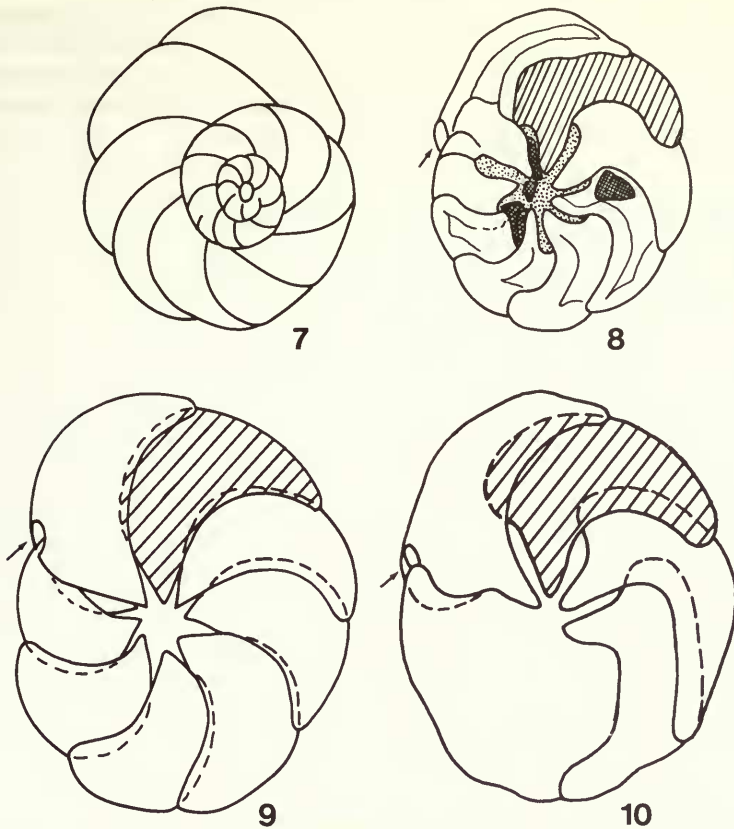
Figs 1–6 *Deuterammina* (*Lepidodeuterammina*) *ochracea* (Williamson) subgen. nov. Lectotype (1963.2.19.16). Figs 1–4, spiral, edge, oblique-umbilical and umbilical views; 5, details of umbilical depression seen obliquely; 6, early enrolment (note ellipsoidal proloculus). Figs 1–4, $\times 175$; fig. 5, $\times 500$; fig. 6, $\times 1250$.

Chosen from Williamson's remaining two syntypes, labelled 'Sand from Shetland', off N. Scotland, in shallow water. Previously figured (drawing) by Hedley *et al.*, 1964, fig. 3 : 2.

curved. Umbilicus narrow, open, star-shaped; chambers overlapping with inflated proximal margins and pointed umbilical extensions. Two sets of apertures per chamber: a rounded primary extraumbilical aperture situated peripherally and visible only in the last chamber; and a secondary elongate aperture in an umbilical-sutural, posteriorly directed position, below the upturned edge of the pointed umbilical lobe. Wall thin, agglutinated, single-layered and imperforate. Spiral side composed of a rather smooth mosaic of minute, well-cemented, rock flakes and mineral grains. Umbilical side more coarsely granular.

DIMENSIONS. (Lectotype). Maximum and minimum diameter $240 \times 200 \mu\text{m}$; thickness (axial height) $45 \mu\text{m}$.

REMARKS. Spirally, the sutures are not well defined and the thick spiral suture shown by Williamson (1858: fig. 112) has not been observed. On the umbilical side the 8 crescentic chambers each overlap strongly posteriorly, while anteriorly, and distal to the umbilical lobe, the chamber outline undergoes a humpback-like enlargement quite different from other 'watch-glass' shaped forms (compare figs 9 and 10). This widening seems to be an essential feature of the taxon. The umbilical lobes are upturned (fig. 5) and may be compared to the blades of a turbine; underneath them the posteriorly directed secondary apertures open into the umbilical (axial) cavity. The narrow gap between the lobes of the last two chambers is



Figs 7, 8 *Deuterammina* (*Lepidodeuterammina*) *ochracea* (Williamson) subgen. nov. Lectotype (1963.2.19.16). Fig. 7, spiral side showing the rapid increase in chamber size during growth, $\times 175$. Fig. 8, umbilical side showing the shape of the penultimate chamber (wide hatching), and the star-shaped umbilical depression (stippled); adventitious matter (crossed hatched). Primary aperture arrowed. $\times 175$. Drawings based on SEM photographs, figs 1, 4.

Figs 9, 10 Diagrams showing form of chamber and umbilical lobe in species of *Deuterammina* (*Lepidodeuterammina*). Fig. 9, *D.* (*Lepidodeuterammina*) sp., illustrated as *Trochammina squamata astrifica* Rhumbler, in Lévy *et al.*, 1974, pl. 1, fig. 9. Fig. 10, *D.* (*Lepidodeuterammina*) *ochracea* (Williamson). Lectotype (1963.2.19.16). Shape of penultimate chamber marked by wide hatching and primary aperture by arrows, in both cases. Based on SEM photographs. Fig. 9, $\times 215$; fig. 10, $\times 250$.

about $45\ \mu\text{m}$ long and $7\ \mu\text{m}$ wide. The rim of the primary aperture is slightly damaged and is difficult to see in figs 2–4, its position is indicated in the drawings, figs 8, 10. The chambers of the umbilical side have a tendency to collapse which suggests that the agglutinant is less well cemented than on the spiral side.

II. The systematic position of *Rotalina ochracea* Williamson

Williamson's original coloured illustrations (1858, figs 112, 113) are somewhat stylised, in particular the spiral side (fig. 112) which shows an unusually strong spiral suture. Whatever their shortcomings they served as a standard reference for the identification of many morphologically related, but discrete, small 'watch-glass' shaped trochamminids referred to *Trochammina ochracea*, or to the group of forms typified by *T. ochracea*. Of the many references to this species, only those of Murray (1970, pl. 1, figs 2, 3; 1971 : 37, pl. 11, figs 1–5), Haynes

(1973: 40, pl. 5, figs 15–18) and Lévy *et al.* (1974, pl. 1, figs 1, 3) are conspecific with the lectotype. Rhumbler (1938) and Höglund (1947) attempted to differentiate taxonomically between these small 'watch-glass' shaped trochamminids, but it is only the advent of SEM that has made it possible to see and illustrate the often minute umbilical and apertural features significant for the classification of this difficult group.

As a result of comparative SEM work on material from the Collections of the R.R.S. *Discovery*, Brönnimann (1976) erected the new genus *Deuterammina*, type species: *Trochammina glabra* Heron-Allen & Earland, to accommodate all previously described species of *Trochammina* which were found to possess two apertures per chamber: a primary, intermarginal and a secondary umbilical opening, the latter situated at the umbilical tip of the chamber in an umbilical-sutural, posteriorly directed, position. By this definition, the overall shape of the test was not taken into consideration at all, and therefore not only forms with rounded peripheries, subglobular chambers and little compression of the test, but also those with almost angular peripheries, strongly compressed chambers and a flattened test, were placed in *Deuterammina*. However, in the course of subsequent work on shallow water deuteramminids (Brönnimann & Whittaker, in preparation) we are now of the opinion that the overall form of the test has also to be taken into account, but only as a classificatory factor of second order to the apertural characteristics. The overall shape of the deuteramminid shell seems to be in direct relationship to the environment in which it lives. In our South Atlantic and Antarctic material flattened 'watch-glass' shaped tests occur in shallow water and tests with subglobular chambers, in relatively deeper water and in the deep sea. The former live attached to a substrate represented by sand grains, seaweed, fragments of bivalves, etc., a moveable biotope in the sense of Rhumbler, 1938. The latter probably live free on or in the uppermost layers of the sediment. These observations are substantiated by findings elsewhere (Brönnimann, 1978; Brönnimann & Maisonneuve, 1980; Lutze, 1974) and by records of *Trochammina ochracea* in the collections of the BMNH from British waters. We therefore propose to formally erect subgenera of *Deuterammina* based on the degree of compression of the test, this subdivision reflecting the environment in which the animals lived. *Deuterammina* (*Deuterammina*) is proposed for all forms typified by *D. glabra* (Heron-Allen & Earland) and *Deuterammina* (*Lepidodeuterammina*) for all the forms with flattened tests typified by *T. ochracea* (Williamson).

Genus **DEUTERAMMINA** Brönnimann, 1976,
emended Brönnimann & Whittaker, herein.

EMENDED GENERIC DEFINITION. Test trochospiral, free or attached. Wall agglutinated, single layered, imperforate. Chambers subglobular or axially strongly compressed; without inner structures. Two sets of apertures: primary opening interiomarginal, umbilical-extraumbilical; secondary or supplementary opening at tip of chamber, umbilical-sutural, posteriorly directed.

TYPE SPECIES. *Trochammina glabra* Heron-Allen & Earland, 1932. Recent. Antarctic waters, outer shelf species.

Subgenus **DEUTERAMMINA (DEUTERAMMINA)** Brönnimann, 1976

SUBGENERIC DEFINITION. Test trochospiral, free, Chambers subglobular. Primary aperture interiomarginal, umbilical-extraumbilical or extraumbilical; secondary or supplementary aperture at umbilical tip of chamber, umbilical-sutural, posteriorly directed.

TYPE SPECIES. As genus.

Subgenus **DEUTERAMMINA (LEPIDODEUTERAMMINA)** subgen. nov.

SUBGENERIC DEFINITION. Test trochospiral, 'watch-glass' shaped, attached. Chambers axially strongly compressed. Primary aperture interiomarginal, extraumbilical; secondary or supplementary aperture at umbilical tip of chamber, umbilical-sutural, posteriorly directed.

TYPE SPECIES. *Rotalina ochracea* Williamson, 1858. Recent. North Atlantic seaboard. Shallow-water species.

NAME. From the Greek, lepto + deuter + ammina, meaning scale-like (shell) with two (apertures) and made of 'sand'. The prefix of the new subgenus in particular refers to the very thin, flattened, concavo-convex nature of the test which we have termed 'watch-glass' shaped.

REMARKS. The primary interiomarginal aperture of *Deuterammina* (*Deuterammina*) *glabra* is an elongate narrow umbilical-extraumbilical slit, whereas that of *D.* (*Lepidodeuterammina*) (e.g. the type species and *D.* (*L.*) *labiosa* (Höglund) (1947, pl. 15, fig 6a-c) is either subperipheral in position or (e.g. a new species of *D.* (*L.*) from Brazil, Brönnimann, in press) of *Trochammina*-type, also a small rounded opening, but this time about halfway between the umbilical cavity and the periphery of the test. Slit-like primary interiomarginal umbilical-extraumbilical or extraumbilical openings have so far not been observed in the 'watch-glass' shaped, attached deuteramminids which seem to be characterised by small, rounded extraumbilical interiomarginal primary openings. These differences in the *form* and *position* of the primary openings are possibly taxonomically of more weight than here accorded but only future work will show whether or not they are of generic, rather than subgeneric significance.

In order to avoid confusion with other attached trochamminids, viz. *Asterotrochammina*, *Remaneica* and *Rotaliammina*, *Deuterammina* (*Lepidodeuterammina*) differs in the following respects: *Asterotrochammina* and *Remaneica* have invaginations (or secondary septa); on the umbilical radial sutures in the former, in the latter, on the spiral side as well. *Rotaliammina* and *D.* (*Lepidodeuterammina*) do not have invaginations but differ from each other in apertural characters: the latter has a double deuteramminid aperture, a primary, extraumbilical interiomarginal aperture, and a secondary opening at the umbilical tip of the chamber. *Rotaliammina* possesses only a single, umbilically (axially) directed aperture. For further discussion of these genera see Seiglie & Bermúdez, 1977, and Brönnimann, 1978.

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